

# Ion NECHITA

## PERSONAL DATA

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## WORK EXPERIENCE

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PRESENT OCTOBER 2010	CNRS, Chargé de recherche 1ère classe LABORATOIRE DE PHYSIQUE THÉORIQUE, TOULOUSE. Research-only, permanent position, working in the team <i>Quantware</i> , fo- cusing on random matrices and quantum theory.
PRESENT MAY 2014	von Humboldt fellow (Experienced Researcher) Research on Quantum Information Theory at TU MÜNCHEN.
JULY 2010 JULY 2009	Postdoctoral Researcher at UNIVERSITY OF OTTAWA Advisor: Benoît Collins – Research focused on Random Matrix Theory, free probability and interactions with Quantum Information Theory.
AUGUST 2009 SEPTEMBER 2006	PhD Student at INSTITUT CAMILLE JORDAN, Université Lyon 1 Courses taught include: Introduction to calculus, Linear algebra, Intro- duction to probability theory, Multivariate calculus.

## EDUCATION

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2006 - 2009 **PhD in Probability theory** at the University of Lyon  
Thesis: *Random states, quantum information theory and free probability*  
– Defended in March 2009  
Advisor: Stéphane Attal – Examination board: Philippe Biane, Benoît  
Collins, Alice Guionnet, Christophe Sabot, Karol Zyczkowski

2005 - 2006 **Master2 de Mathématiques** (MSc) at ENS Lyon  
Thesis: *Random density matrices* – Advisor: Stéphane Attal

2004 - 2005 **Maîtrise de Mathématiques** (BSc) at ENS Lyon  
Thesis: *An introduction to quantum information theory* – Advisor:  
Stéphane Attal

2003 - 2004 **Licence de Mathématiques** at ENS Lyon  
Thesis: *Zeros of a Gaussian random series: a determinantal process* –  
Advisor: André Goldman

2003 - 2006 Student at the **Ecole Normale Supérieure de Lyon**, France

2001 - 2003 Preparatory classes at **Intitut National des Sciences Appliquées**,  
Lyon, France

2001 Romanian **baccalaureate** with high honors

## PUBLICATION LIST

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1. *On bipartite unitary matrices generating subalgebra-preserving quantum operations* (with Tristan Benoist) - to appear in *Linear Algebra and its Applications* (2017)
2. *Flat matrix models for quantum permutation groups* (with Teodor Banica) - *Adv. Appl. Math.* 83, 24-46 (2017)
3. *On some classes of bipartite unitary operators* (with Julien Deschamps and Clément Pellegrini) - *J. Phys. A: Math. Theor.* 49 335301 (2016)
4. *Random and free positive maps with applications to entanglement detection* (with Benoit Collins and Patrick Hayden) - *International Mathematics Research Notices*, rnw054 (2016)
5. *On the asymptotic distribution of block-modified random matrices* (with Octavio Arizmendi and Carlos Vargas) - *Journal of Mathematical Physics* 57, 015216 (2016)
6. *Random matrix techniques in quantum information theory* (with Benoit Collins) - *Journal of Mathematical Physics* 57, 015215 (2016)
7. *Almost one bit violation for the additivity of the minimum output entropy* (with Benoit Collins and Serban Belinschi) - *Comm. Math. Phys.* 341(3), 885-909 (2016)
8. *Thresholds for reduction-related entanglement criteria in quantum information theory* (with Maria Anastasia Jivulescu and Nicolae Lupa) - *Quantum Information and Computation*, Vol. 15, No. 13-14 (2015) 1165118
9. *Additivity rates and PPT property for random quantum channels* (with Motohisa Fukuda) - *Ann. Math. Blaise Pascal* 22, 1-72 (2015)
10. *On the convergence of output sets of quantum channels* (with Benoit Collins and Motohisa Fukuda) - *J. Operator Theory*, 73:2(2015), 333-360
11. *Quantum channels with polytopic images and image additivity* (with Motohisa Fukuda and Michael M. Wolf) - *IEEE Transactions on Information Theory*, vol.61, no.4, pp. 1851-1859 (2015)
12. *Positive reduction from spectra* (with Maria Anastasia Jivulescu, Nicolae Lupa, and David Reeb) - *Linear Algebra and its Applications* 469 (2015) 276-304
13. *On the reduction criterion for random quantum states* (with Maria Anastasia Jivulescu and Nicolae Lupa) - *J. Math. Phys.* 55, 112203 (2014)
14. *Analytic aspects of the circulant Hadamard conjecture* (with Teodor Banica and Jean-Marc Schlenker) - *Ann. Math. Blaise Pascal* 21 (2014), 25-59
15. *Asymptotically well-behaved input states do not violate additivity for conjugate pairs of random quantum channels* (with Motohisa Fukuda) - *Comm. Math. Phys.* Vol. 328, No. 3 (2014), 995-1021
16. *A universal set of qubit quantum channels* (with Daniel Braun, Olivier Giraud, Clément Pellegrini and Marko Znidarić) - *J. Phys. A: Math. Theor.* 47 (2014) 135302
17. *Submatrices of Hadamard matrices: complementation results* (with Teodor Banica and Jean-Marc Schlenker) - *Electron. J. Linear Algebra* 27 (2014), 197-212
18. *Area law for random graph states* (with Benoit Collins and Karol Życzkowski) - *J. Phys. A: Math. Theor.* 46 305302 (2013)
19. *Almost Hadamard matrices: the case of arbitrary exponents* (with Teodor Banica) - *Discrete Applied Mathematics*, vol. 161, no. 16-17, 2367-2379 (2013)
20. *Random pure quantum states via unitary Brownian motion* (with Clément Pellegrini) - *Electron. Commun. Probab.* 18 (2013), no. 27, 1-13
21. *Low entropy output states for products of random unitary channels* (with Benoit Collins and Motohisa Fukuda) - *Random Matrices: Theory Appl.* 02, 1250018 (2013)
22. *Almost Hadamard matrices: general theory and examples* (with Teodor Banica and Karol Życzkowski) - *Open Systems & Information Dynamics*, Vol. 19, No. 4, 1250024 (2012)
23. *Realigning random states* (with Guillaume Aubrun) - *J. Math. Phys.* 53, 102210 (2012)

24. *Block-modified Wishart matrices and free Poisson laws* (with Teodor Banica) - Houston Journal of Mathematics, Volume 41, No. 1 (2015)
25. *The absolute positive partial transpose property for random induced states* (with Benoit Collins and Deping Ye) - Random Matrices: Theory Appl. 01, 1250002 (2012)
26. *Towards a state minimizing the output entropy of a tensor product of random quantum channels* (with Benoit Collins and Motohisa Fukuda) - J. Math. Phys. 53, 032203 (2012)
27. *The multiplicative property characterizes  $\ell_p$  and  $L_p$  norms* (with Guillaume Aubrun) - Confluentes Mathematici, Volume 3, Number 4 (2011), pp. 637-647
28. *Asymptotic eigenvalue distributions of block-transposed Wishart matrices* (with Teodor Banica) - J. Theoret. Probab. 26 (2013), 855-869
29. *Eigenvectors and eigenvalues in a random subspace of a tensor product* (with Benoit Collins and Serban Belinschi) - Inventiones mathematicae, vol. 190, no. 3, 2012, pp. 647-697
30. *Generating random density matrices* (with Benoit Collins, Karol Penson and Karol Zyczkowski) - J. Math. Phys. 52, 062201 (2011)
31. *Random repeated quantum interactions and random invariant states* (with Clément Pellegrini) - Probab. Theory Relat. Fields (2012) 152:299-320
32. *Gaussianization and eigenvalue statistics for Random quantum channels (III)* (with Benoit Collins) - Ann. Appl. Probab. Volume 21, Number 3 (2011), 1136-1179
33. *Random quantum channels II: Entanglement of random subspaces, Rényi entropy estimates and additivity problems* (with Benoit Collins) - Advances in Mathematics 226 (2011), 1181-1201
34. *Eigenvalue and Entropy Statistics for Products of Conjugate Random Quantum Channels* (with Benoit Collins) - Entropy (2010), 12(6), 1612-1631
35. *Random graph states, maximal flow and Fuss-Catalan distributions* (with Benoit Collins and Karol Zyczkowski) - J. Phys. A: Math. Theor. 43 (2010), 275303
36. *Discrete approximation of the free Fock space* (with Stéphane Attal) - Sminaire de Probabilités XLIII, LNM, (2011), vol. 2006/2011, 379-394
37. *Random quantum channels I: graphical calculus and the Bell state phenomenon* (with Benoit Collins) - Comm. Math. Phys. 297 (2010), no. 2, 345-370
38. *Quantum Trajectories in Random Environment: the Statistical Model for a Heat Bath* (with Clément Pellegrini) - Confluentes Mathematici, Vol. 1, No. 2 (2009), 249-289
39. *A permutation model for free random variables and its classical analogue* (with Florent Benaych-Georges) - Pacific Journal of Math., Vol. 242 (2009), No. 1, 33-51
40. *Stochastic domination for iterated convolutions and catalytic majorization* (with Guillaume Aubrun) - Ann. Inst. H. Poincaré Probab. Statist. Volume 45, Number 3 (2009), 611-625
41. *Catalytic majorization and  $\ell_p$  norms* (with Guillaume Aubrun) - Comm. Math. Phys. 278 (2008), no. 1, 133-144
42. *Asymptotics of random density matrices* - Ann. Henri Poincaré 8 (2007), no. 8, 1521-1538

## SELECTED LIST OF TALKS IN CONFERENCES AND SEMINARS

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1. *Quantum channels, groups, and non-commutative iterative scaling algorithms* - CIMI workshop Complex analysis and noncommutative functions, Toulouse - October 2016
2. *Block-modified random matrices, operator-valued free probability, and applications to entanglement theory* - Mathematical Aspects in Current Quantum Information Theory, Daejeon, Korea - February 2016
3. *Random quantum channels and additivity violations* - invited talk, Quantum Groups and Quantum Information Theory, Herstmonceux - July 2015
4. *Random matrices and their use in Quantum Information Theory* - lecture at the 14ème Annual Canadian Summer School on Quantum Information, Guelph - June 2014

5. *Random matrix theory with a view towards free probability, and connections to quantum information* - lecture given at the workshop New Mathematical Directions for Quantum Information workshop, Newton Institute, Cambridge - September 2013
6. *Positive and completely positive maps via free additive powers of probability measures* - invited talk at the EMS-DMF joint mathematical weekend, Aarhus - Avril 2013
7. *Random subspaces of a tensor product and the additivity problem* - DMV Annual Meeting 2012, Saarland University - September 2012
8. *Random subspaces of a tensor product and the additivity problem* - XIème Colloque Franco-Roumain de Mathématiques Appliquées, Bucuresti - August 2012
9. *Random subspaces of a tensor product and the additivity problem* - Operator Spaces, Quantum Probability and Applications Workshop, Wuhan - June 2012
10. *Statistical properties of random quantum channels* - invited talk, workshop CIRM Geometry of Quantum Entanglement - January 2012
11. *Block-modified Wishart matrices and applications to entanglement theory* - 14th Non-commutative harmonic analysis Workshop, Bedlewo - September 2011
12. *Positivity in Quantum Information Theory* - Positivity Workshop, Fields Institute, Toronto - August 2011
13. *Graphical calculus for random quantum channels* - Mittag-Leffler program on QIT, Stockholm - November 2010
14. *Random graph states, maximum flow on networks and the Fuss-Catalan ensembles of density matrices* - IQC Colloquium, Waterloo - March 2010
15. *Random matrix models in quantum information theory* - Conférencier invité, Canadian Mathematical Society Winter Meeting, Windsor - December 2009
16. *Majorization, entanglement catalysis, stochastic domination and  $\ell_p$  norms* - Conférencier invité, Fields Workshop on Operator Structures in Quantum Information, Toronto - July 2009
17. *Random density matrices* - Open Quantum Systems Days, Marseille - November 2006

## AWARDS AND GRANTS

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- 2016: grant for a 3-week research stay at the Mathematisches Forschungsinstitut Oberwolfach. Project title: “Applications of Real Algebraic Geometry in Quantum Information Theory”
- 2016: CNRS grant, Inphyniti call Project title: “[MISTEQ](#)” (coordinator, 1 year)
- 2014: von Humboldt Fellowship for Experienced Researchers (research grant, 18 months) at Technische Universität München.
- 2014: ANR grant “STOQ” - Stochastic methods in quantum mechanics (member, 3 years)
- 2013: CNRS grant, Quantum Information and Communication call. Project title: “COGIT” (coordinator, 1 year)
- 2012 : Procope grant for the project *Random matrix theory and free probability* (coordinator, 3 years, joint with Roland Speicher, University of Saarlandes)
- 2012 : ANR Blanc International grant for the project *RMTQIT* - Random matrix techniques in Quantum Information Theory (coordinator, 300k€, 3 years, joint with Politehnica University, Timisoara, Romania)
- 2011 : AO1 research grant from the University of Toulouse (coordinator, joint with a team from IRIT) for the project *Compressed sensing in ultrasound imaging: theory and applications*
- 2011 : ANR project *OSvsQPI* - Interactions between Operator Space Theory and Quantum Probability with Applications to Quantum Information (member, 3 years)
- 2011 : Prime d'excellence scientifique (excellence in science award) from CNRS, 3 years
- 2010 : PEPS grant from CNRS (coordinator) for the project *Random constructions in Quantum Information Theory*

- 2010 : Travel grant from the University of Toulouse for a 3 months stay in Ottawa, Canada

## RESEARCH STUDENTS, POSTDOCTORAL FELLOWS

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- Tristan Benoist, postdoctoral fellow, March 2015 - August 2016

## ACADEMIC SERVICE

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- September - December 2017 : Co-organizer of the trimester [Analysis in Quantum Information Theory](#) at the IHP, Paris
- 23-25 January 2017 : Co-organizer of the workshop [Quantum trajectories, parameter and state estimation](#) at the IMT in Toulouse
- 11-22 July 2016 : Co-organizer of the summer school [Stochastic Methods in Quantum Mechanics](#) in Autrans, France
- 18-22 January 2016 : Co-organizer of the workshop [Linear Matrix Inequalities, Semidefinite Programming and Quantum Information Theory 2016](#) at the LPT Toulouse
- 5-7 November 2015 : Co-organizer of the workshop [Mathematical Methods in Quantum Information Theory](#) at the Politehnica University in Timisoara
- 9-11 September 2015 : Co-organizer of the workshop [Quantum Thermodynamics and Quantum Information Theory](#) in Toulouse
- 27-29 August 2014 : Organizer of the “Random Matrices” session within the [MAS days](#) in Toulouse
- 13-15 November 2013 : Co-organizer of the [second meeting](#) of the “COGIT” CNRS PEPS-ICQ meeting in Toulouse.
- 5-7 June 2013 : Co-organizer of the first meeting of the “COGIT” CNRS PEPS-ICQ meeting in Rouen
- 24th May 2013 : Co-organizer of the [annual meeting](#) of the Mathematics and Theoretical Physics departments at the University of Toulouse
- 24th May 2012 : Co-organizer of the [annual meeting](#) of the Mathematics and Theoretical Physics departments at the University of Toulouse
- 14-16 May 2012 : Co-organizer, with Stéphane Attal and Clément Pellegrini of the workshop [Probabilistic Methods in Quantum Mechanics](#) at the University of Lyon
- 16-18 November 2011 : Co-organizer, with Stéphane Attal and Clément Pellegrini of the [Open Quantum Systems and Quantum Information Theory](#) workshop at the University of Toulouse
- 4th of April 2011 : Co-organizer of the [annual meeting](#) of the Mathematics and Theoretical Physics departments at the University of Toulouse
- July 2010: Co-organizer, with Benoit Collins and Patrick Hayden, of an [international conference](#) at the Perimeter Institute on random matrices and quantum information theory
- 2009 - 2010: Informal supervision of Muneerah Al-Nuwairan, a graduate student at the University of Ottawa
- 2008 - 2009: Co-organization of the PhD Students’ Seminar at Institut Camille Jordan, Université Lyon 1, France
- Referee for CNRS (France), NSERC (Canada) and the National Science Center (Poland)
- Referee for the following journals: Annales Henri Poincaré, Electronic Journal of Probability, Phys. Rev. A, Bernoulli, Comm. in Math. Phys., Probability Theory and Related Fields, Journal of Mathematical Physics, Quantum Information & Computation
- Report writer for the AMS Reviews (*MathSciNet*)

## LANGUAGES

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ROMANIAN: Mothertongue  
ENGLISH: Fluent  
FRENCH: Fluent  
GERMAN: Good knowledge (B1 level)